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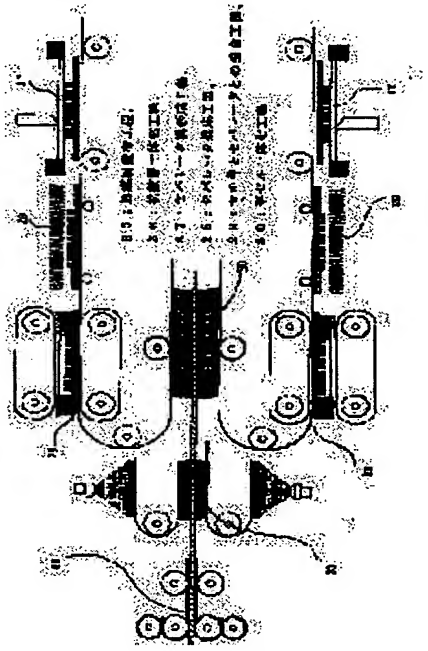
(71)Applicant : FUJI ELECTRIC CO LTD
(72)Inventor : NAGAYAMA KAZUHIKO

(54) METHOD OF PRODUCING SOLID HIGH POLYMER FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of producing a solid high polymer fuel cell, allowing integral adhesion of parts in a process for producing the cell and offering improved assembly and reduced electric contact resistance.
SOLUTION: In a catalyst layer applying a process 25 for applying a catalyst layer on an electrolytic film, the catalyst layer is formed and a catalyst layer and electrolyte junction are integrated by using a hot roll. Then, in a diffusion layer integrating process 26 for integrating a diffusion layer, the diffusion layers with an electrolytic solution applied after drying are arranged on both faces of the catalyst layer and electrolyte junction and are joined with the hot roll. In a process 29 for joining a separator formed in a gas flow passage channel forming process 27 and fired in a firing process 28 to a cell frame, the cell frame to which a bonding layer is provided at its periphery is joined to the separator with the hot roll. Finally, in a process 30 for integrating unit cells, the cell frames joined to the separator are placed on both faces of the catalyst layer and electrolyte junction integrated with the diffusion layer and integrated with the hot roll to continuously form the unit cells.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The catalyst bed and electrolyte zygote which comes to have a catalyst bed in both principal planes on both sides of the solid-state polyelectrolyte film, The separator which comes to have the fuel gas passage for supplying and discharging the fuel gas which contains hydrogen in the diffusion layer of the porosity arranged in the both sides of this zygote, and one diffusion layer, In the approach of manufacturing the polymer electrolyte fuel cell cel which equipped the diffusion layer of another side with the separator which comes to have the oxidant gas passage for supplying and discharging oxidant gas The manufacture approach of the polymer electrolyte fuel cell cel characterized by joining said catalyst bed and electrolyte zygote, diffusion layer, and said both separators with thermocompression bonding or adhesives, and unifying the whole fuel cell cel.
[Claim 2] The catalyst bed and electrolyte zygote which comes to have a catalyst bed in both principal planes on both sides of the solid-state polyelectrolyte film, The separator which comes to have the fuel gas passage for supplying and discharging the fuel gas which contains hydrogen in the diffusion layer of the porosity arranged in the both sides of this zygote, and one diffusion layer, In the approach of manufacturing the polymer electrolyte fuel cell cel which equipped the diffusion layer of another side with the separator which comes to have the oxidant gas passage for supplying and discharging oxidant gas The manufacture approach of the polymer electrolyte fuel cell cel characterized by applying the solution of a solid-state polyelectrolyte to said diffusion layer, carrying out thermocompression bonding of said catalyst bed and electrolyte zygote, and diffusion layer, and unifying.
[Claim 3] It is the manufacture approach of the polymer electrolyte fuel cell cel characterized by performing solution spreading of said electrolyte by one approach of a spray method, screen printing, and roll print processes in the manufacture approach according to claim 2.
[Claim 4] It is the manufacture approach of the polymer electrolyte fuel cell cel characterized by performing said thermocompression bonding by hot pressing or the heated roll method in the manufacture approach according to claim 2.
[Claim 5] The manufacture approach of the polymer electrolyte fuel cell cel characterized by pasting up said both separators through a frame-like cel frame, and unifying the whole fuel cell cel in the manufacture approach according to claim 1 after unifying said catalyst bed and electrolyte zygote, and diffusion layer.
[Claim 6] The manufacture approach of the polymer electrolyte fuel cell cel characterized by forming a glue line in the separator of a frame-like cel frame, and an adhesion side with an electrolyte membrane beforehand for said adhesion, and unifying by thermocompression bonding in the manufacture approach according to claim 5.
[Claim 7] It is the manufacture approach of the polymer electrolyte fuel cell cel characterized by forming said glue line with screen-stencil or sheet-like adhesives in the manufacture approach according to claim 6.
[Claim 8] It is the manufacture approach of the polymer electrolyte fuel cell cel characterized by performing said thermocompression bonding by hot pressing or the heated roll method in the manufacture approach according to claim 5.
[Claim 9] It is the manufacture approach of the polymer electrolyte fuel cell cel characterized by forming by carrying out heating compression before it applies to both sides of the direct solid-state

polyelectrolyte film the catalyst bed which pasted said catalyst bed and electrolyte zygote in the manufacture approach according to claim 1 to 8 and an electrolyte membrane causes deformation by swelling with the paste solution at the time of spreading.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a polymer electrolyte fuel cell cel.
[0002]
[Description of the Prior Art] A fuel cell is equipment which uses hydrogen and oxygen, intervenes an electrolyte and generates the direct-current electrical and electric equipment. Ion conductivity is shown by a poly membrane carrying out water as an electrolyte, and, as for a polymer electrolyte fuel cell, the perspective view of the configuration of the fuel cell cel is shown [which used the perfluoro ethylene sulfonic-acid-type-resin film, for example] in drawing 6 . In drawing 6 , in both sides of an electrolyte membrane 51, it has the catalyst bed 50 which consists of platinum or a platinum compound, and the diffusion layer 53 of the porosity which consists of carbon paper, a carbon cross, etc., and it has the fuel gas passage for supplying and discharging further the fuel gas which contains hydrogen in one diffusion layer, and the diffusion layer of another side is equipped with the separator 52 which comes to have the oxidant gas passage for supplying and discharging oxidant gas. In addition, in drawing 6 , although said separator shows what has a gas passageway on both sides of one separator, it may carry out the laminating of what has passage in one side back to back from the reasons of manufacture. What carried out the laminating of many above-mentioned cels is called stack.
[0003]
[Problem(s) to be Solved by the Invention] As mentioned above, a polymer electrolyte fuel cell cel consists of an assembly object of many components. Whether the mark of assembly components are made and to unify what can unify preferably from a viewpoint of mass-production nature beforehand the activity which carries out the laminating of these components, assembles many cels as a stack, and is unified in the manufacture process of components, and to decrease are desired. Moreover, mitigation of the electric contact resistance between components is also independently wished the above-mentioned number of assemblers from a viewpoint of a property improvement of a fuel cell. If there is many contact between components, increase of the part and contact resistance will be brought about.
[0004] This invention was made in view of the above-mentioned point, and the technical problem of this invention is to offer the manufacture approach of a polymer electrolyte fuel cell cel of having attained adhesion unification of components in the manufacture process of a fuel cell cel, and having aimed at improvement of assembly nature, and mitigation of electric contact resistance.
[0005]
[Means for Solving the Problem] The catalyst bed and electrolyte zygote with which this invention comes to have a catalyst bed in both principal planes on both sides of the solid-state polyelectrolyte film in order to solve the above-mentioned technical problem, The separator which comes to have the fuel gas passage for supplying and discharging the fuel gas which contains hydrogen in the diffusion layer of the porosity arranged in the both sides of this zygote, and one diffusion layer, In the approach of manufacturing the polymer electrolyte fuel cell cel which equipped the diffusion layer of another side with the separator which comes to have the oxidant gas passage for supplying and discharging oxidant gas Suppose that said catalyst bed and electrolyte zygote, diffusion layer,

and said both separators are joined with thermocompression bonding or adhesives, and the whole fuel cell cel is unified (claim 1).
[0006] According to the above, the activity which assembles many cels as a stack and is unified becomes easy, and mitigation of electric contact resistance can be aimed at by adhesion unification of each part article.
[0007] Moreover, the whole fuel cell cel is not unified like above-mentioned claim 1, but like invention of claim 2, even if it unifies partially a catalyst bed and an electrolyte zygote, and a diffusion layer, suitable effectiveness is acquired. Namely, the catalyst bed and electrolyte zygote which comes to have a catalyst bed in both principal planes on both sides of the solid-state polyelectrolyte film, The separator which comes to have the fuel gas passage for supplying and discharging the fuel gas which contains hydrogen in the diffusion layer of the porosity arranged in the both sides of this zygote, and one diffusion layer, In the approach of manufacturing the polymer electrolyte fuel cell cel which equipped the diffusion layer of another side with the separator which comes to have the oxidant gas passage for supplying and discharging oxidant gas The solution of a solid-state polyelectrolyte is applied to said diffusion layer, and suppose that thermocompression bonding of said catalyst bed and electrolyte zygote, and diffusion layer is carried out, and it unifies.
[0008] As an embodiment of said claims 1 or 2, the following approach is suitable. That is, in the manufacture approach according to claim 2, solution spreading of said electrolyte is performed by one approach of a spray method, screen printing, and roll print processes (claim 3). Moreover, in the manufacture approach according to claim 2, said thermocompression bonding is performed by hot pressing or the heated roll method (claim 4). furthermore, in the manufacture approach according to claim 1, after unifying said catalyst bed and electrolyte zygote, and diffusion layer, said both separators are pasted up through a frame-like cel frame, and the whole fuel cell cel is unified -- the following is suitable as an embodiment of said claim 5 again (claim 5). That is, in the manufacture approach according to claim 5, a glue line is beforehand formed in the separator of a frame-like cel frame, and an adhesion side with an electrolyte membrane for said adhesion, and it unifies by thermocompression bonding (claim 6). Furthermore, in said manufacture approach according to claim 6, said glue line is formed with screen-stencil or sheet-like adhesives (claim 7). Moreover, in the manufacture approach according to claim 5, said thermocompression bonding is performed by hot pressing or the heated roll method (claim 8).
[0009] It sets to the manufacture approach according to claim 1 to 8 like invention of claim 9. Furthermore, said catalyst bed and electrolyte zygote By supposing that it forms by carrying out heating compression before it applies the pasted catalyst bed to both sides of the direct solid-state polyelectrolyte film and an electrolyte membrane causes deformation by swelling with the paste solution at the time of spreading Improvement in the mass-production nature based on [the adhesion unification of the elegance is all carried out, and] a flow production process of a fuel cell cel and mitigation of the contact electricity resistance can be aimed at.
[0010]
[Embodiment of the Invention] Based on a drawing, the gestalt of implementation of this invention is described below.
[0011] Drawing 1 is drawing explaining the process which is concerned with the example of invention of claim 9 and performs continuously manufacture from manufacture of a catalyst bed and an electrolyte zygote to the formation of a single cel. Although the detail of each process is mentioned later, drawing 1 explains the outline of all processes below.
[0012] First, the catalyst bed was formed in the spreading process 25 of the catalyst bed to an electrolyte membrane top, for example, the catalyst bed and the electrolyte zygote were unified using the heated roll. Next, in the diffusion layer unification process 26, the electrolytic solution was applied to the diffusion layer, and the diffusion layer after desiccation has been arranged to both sides of a catalyst bed and an electrolyte zygote, for example, the diffusion layer was joined with the heated roll by performing heating deformation of the temperature of 80-150 degrees C, and 30 - 80% of reduction of area.
[0013] Next, the separator to which the slot pattern was applied in the formation process 27 of the gas-passageway slot on the separator was calcinated at the baking process 28, and the cel frame and separator which attached the glue line to the perimeter section at the junction process 29 of a cel

frame and a separator were joined with the heated roll at the temperature of 80-150 degrees C, and 30 - 80% of reduction of area.
[0014] The single cel was continuously obtained by laying in both sides what joined the cel frame to the separator in the single cel unification process 30, finally, although the catalyst bed and the electrolyte zygote, and the diffusion layer were unified, and unifying with a heated roll at the temperature of 80-150 degrees C, and 30 - 80% of reduction of area.
[0015] Since according to the above all the components of a fuel cell cel flow and adhesion unification is carried out by the production process, improvement in mass-production nature and mitigation of the contact electricity resistance are realizable.
[0016] Next, each aforementioned process is explained in full detail below. Drawing 2 is a sectional view explaining the process 25 which applies a catalyst bed directly on an electrolyte membrane. The ink 1 which mixed the electrolytic solution with the catalyst added and manufactured the electrolytic solution at a 10 - 50wt% rate for the catalyst of a damp or wet condition. After throwing in catalyst bed ink 1 between the recessing roll 3 and the spreading roll 4, making ink collected on a part for the slot of the recessing roll 3 adhere to a spreading roll and applying to the both-sides coincidence of an electrolyte membrane 2, thermocompression bonding is carried out with a heated roll 5 at 100-170 degrees C and 30 - 80% of reduction of area.
[0017] Drawing 3 is drawing explaining the process 26 which unifies a diffusion layer, and a catalyst bed and an electrolyte zygote, in drawing 3 (a), (b) shows the desiccation process of an electrolytic solution and (c) shows the thermocompression bonding process of a catalyst bed and an electrolyte zygote, and a diffusion layer for the spreading process of an electrolytic solution. The electrolytic solution 8 diluted with alcohol is sprayed on diffusion layer 6 front face by the spray nozzle 7, and it dries at the temperature of 80-120 degrees C at a heater 10. Then, according to the adhesion effectiveness of an electrolytic solution, at 100-170 degrees C and 30 - 80% of reduction of area, a heated roll is given and the diffusion layer 9, and the catalyst bed and the electrolyte zygote 11 which applied the electrolytic solution are unified.
[0018] the spreading process of the slot of a gas passageway [in / drawing 4 is drawing explaining the processes 27-29 in drawing 1 , and / in drawing 4 (a) / a separator] -- in (b), (c) shows the spreading process of the glue line to a cel frame, and (d) shows the junction process of a cel frame and a separator for the baking process of this slot.
[0019] The ink 12 for separator slot formation is what added carbon powder and Teflon powder in the solution which mixed binding-material ethyl cellulose 4.2% in the diethylene-glycol ECHIRE ether, it supplies this on the SURIN mesh 13, prints a slot pattern on the front face of the separate plate 15 using a squeegee 14, and calcinates it at the temperature of 150-300 degrees C at a heater 10. The adhesives paste 17 thrown into the SURIN mesh 13 is applied to the front face of the cel frame 16 used as the appearance part of a cel by the squeegee 14, and a glue line 18 is formed in it. It joins to the separator 19 in which the slot was formed, using a hotpress 21 combining the cel frame 20 which attached the glue line by the temperature of 80-200 degrees C, and the pressure of 9.8x105-106Pa (about 10-100kg/cm2).
[0020] Next, drawing 5 is drawing explaining the process 30 in drawing 1 , drawing 5 (a) is drawing which is not illustrated to drawing 1 , the spreading process of the glue line to a cel frame separator unification article is shown, and (b) shows the unification process of a single cel.
[0021] The adhesives paste 17 thrown into the SURIN mesh 13 is applied to the front face of 22 which unified the cel frame and the separator by the squeegee 14. A glue line 18 is formed and it puts by the thing 23 (two sheets) which unified the cel frame and the separator for the thing 24 which unified the catalyst bed and the electrolyte zygote, and the diffusion layer, and attached the glue line to the front face. With a hotpress 21 A single cel is joined and formed by the temperature of 80-200 degrees C, and the pressure of 9.8x105-106Pa (about 10-100kg/cm2).
[0022]
[Effect of the Invention] The catalyst bed and electrolyte zygote which comes to have a catalyst bed in both principal planes on both sides of the solid-state polyelectrolyte film according to this invention the above-mentioned passage, The separator which comes to have the fuel gas passage for supplying and discharging the fuel gas which contains hydrogen in the diffusion layer of the porosity arranged in the both sides of this zygote, and one diffusion layer, In the approach of manufacturing

the polymer electrolyte fuel cell cel which equipped the diffusion layer of another side with the separator which comes to have the oxidant gas passage for supplying and discharging oxidant gas Since said catalyst bed and electrolyte zygote, diffusion layer, and said both separators are joined with thermocompression bonding or adhesives and the whole fuel cell cel is unified, the manufacture approach of a polymer electrolyte fuel cell cel of having aimed at improvement of assembly nature and mitigation of electric contact resistance can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing explaining the outline of all the production processes of the fuel cell cel in connection with the example of this invention
[Drawing 2] Drawing in connection with the spreading process of the catalyst bed in drawing 1
[Drawing 3] Drawing in connection with the unification process of the catalyst bed and electrolyte zygote, and diffusion layer in drawing 1
[Drawing 4] Drawing in connection with the process to manufacture of the separator in drawing 1 , and junction in a cel frame
[Drawing 5] Drawing in connection with the single cel unification process in drawing 1
[Drawing 6] The perspective view of the configuration of a fuel cell cel
[Description of Notations]
1, 12:ink, 2:electrolyte membrane, 3:recessing roll, 4 : A spreading roll, 5 : A heated roll, 6:diffusion layer, 8:electrolytic solution, 10:heater, 11:catalyst bed and an electrolyte zygote, 16: A cel frame, 18:glue line, 19:separator, 21:hotpress, 25:catalyst-bed spreading process, 26:diffusion-layer unification process, 27:separator slot formation process, 28:separator baking process, the junction process of 29:cel frame and a separator, 30: Single cel unification process.

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(71)出願人　000005234
富士電機株式会社
神奈川県川崎市川崎区田辺新田１番１号
(72)発明者　永山　一彦
神奈川県川崎市川崎区田辺新田１番１号
富士電機株式会社内
(74)代理人　100075166
弁理士　山口　巖　（外２名）

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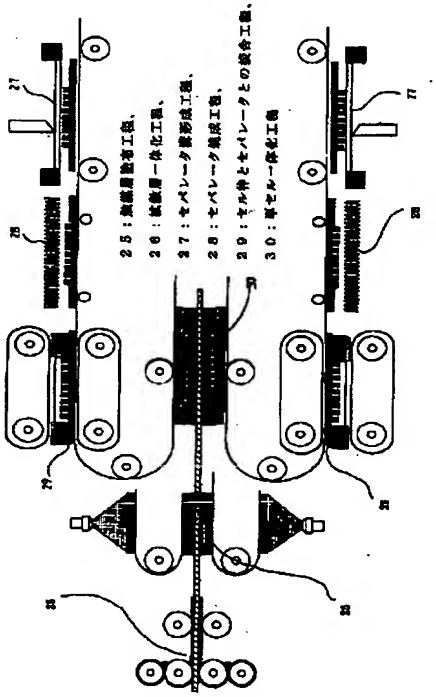
(54)【発明の名称】　固体高分子型燃料電池セルの製造方法

(57)【要約】
【課題】　セル製造過程において部品の密着一体化を図り、組み立て性の改善と電気接触抵抗の軽減を図った固体高分子型燃料電池セルの製造方法を提供する。
【解決手段】　電解質膜上への触媒層塗布工程２５において触媒層を形成し、ホットロールを用いて触媒層・電解質接合体を一体化し、次に、拡散層一体化工程２６において、電解質溶液を拡散層に塗布乾燥後の拡散層を、触媒層・電解質接合体の両面に配置し、ホットロールにより拡散層を接合する。次に、ガス流路溝形成工程２７および焼成工程２８で焼成したセパレータとセル枠との接合工程２９で、周囲部に接着層を付けたセル枠とセパレータとをホットロールにより接合し、最後に、単セル一体化工程３０において、セパレータにセル枠を接合したものを、触媒層・電解質接合体と拡散層とを一体化したものの両面に載置し、ホットロールにて一体化することにより、単セルを連続的に得る。



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【特許請求の範囲】

【請求項１】　固体高分子電解質膜を挟んで両主面に触媒層を有してなる触媒層・電解質接合体と、この接合体の両側に配設した多孔質の拡散層と、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有してなるセパレータと、他方の拡散層に酸化剤ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータとを備えた固体高分子型燃料電池セルを製造する方法において、前記触媒層・電解質接合体と拡散層と前記両セパレータとを熱圧着または接着剤等により接合して、燃料電池セル全体を一体化することを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項２】　固体高分子電解質膜を挟んで両主面に触媒層を有してなる触媒層・電解質接合体と、この接合体の両側に配設した多孔質の拡散層と、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有してなるセパレータと、他方の拡散層に酸化剤ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータとを備えた固体高分子型燃料電池セルを製造する方法において、前記拡散層に固体高分子電解質の溶液を塗布し、前記触媒層・電解質接合体と拡散層とを熱圧着して一体化することを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項３】　請求項２記載の製造方法において、前記電解質の溶液塗布は、スプレー法，スクリーン印刷法，ロール印刷法のいずれかの方法により行うことを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項４】　請求項２記載の製造方法において、前記熱圧着は、ホットプレス法またはホットロール法により行うことを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項５】　請求項１記載の製造方法において、前記触媒層・電解質接合体と拡散層とを一体化した後、前記両セパレータを額縁状のセル枠を介して接着し、燃料電池セル全体を一体化することを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項６】　請求項５記載の製造方法において、前記接着のために額縁状のセル枠のセパレータおよび電解質膜との接着面にあらかじめ接着層を形成し、熱圧着により一体化することを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項７】　請求項６記載の製造方法において、前記接着層は、スクリーン印刷またはシート状接着剤により形成することを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項８】　請求項５記載の製造方法において、前記熱圧着は、ホットプレス法またはホットロール法により行うことを特徴とする固体高分子型燃料電池セルの製造方法。

【請求項９】　請求項１ないし８のいずれかに記載の製

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造方法において、前記触媒層・電解質接合体は、ペースト化した触媒層を直接固体高分子電解質膜の両面に塗布し、塗布時のペースト溶液で電解質膜が膨潤による変形をおこす前に加熱圧縮することによって形成することを特徴とする固体高分子型燃料電池セルの製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、固体高分子型燃料電池セルの製造方法に関する。

【０００２】

【従来の技術】燃料電池は水素と酸素を利用し、電解質を介在して直流電気を発電する装置である。固体高分子型燃料電池は、電解質として、高分子膜が含水することでイオン導電性を示す例えばパーフルオロエチレンスルホン酸樹脂膜を用いたもので、その燃料電池セルの構成の斜視図を図６に示す。図６において、電解質膜５１の両面には、例えば白金または白金化合物からなる触媒層５０と、カーボンペーパーやカーボンクロスなどからなる多孔質の拡散層５３とを備え、さらに、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有し，他方の拡散層に酸化剤ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータ５２とを備える。なお図６において、前記セパレータは、一つのセパレータの両側にガス流路を有するものを示したが、製造上の理由から、片側に流路を有するものを背中合わせに積層する場合もある。上記セルを多数積層したものをスタックという。

【０００３】

【発明が解決しようとする課題】前述のように、固体高分子型燃料電池セルは、多数の部品の組み立て体からなる。これらの部品を積層し、多数のセルをスタックとして組み立て一体化する作業は、量産性の観点から好ましくなく、あらかじめ部品の製造過程で一体化できるものは一体化して、組み立て部品の点数を出来るかぎり低減することが望まれる。また、上記組み立て工数とは別に、部品間の電気的な接触抵抗の軽減も燃料電池の特性改善の観点から望まれる。部品間の接触の数が多いとその分、接触抵抗の増大をもたらす。

【０００４】この発明は、上記の点に鑑みてなされたもので、この発明の課題は、燃料電池セルの製造過程において部品の密着一体化を図り、組み立て性の改善と電気接触抵抗の軽減を図った固体高分子型燃料電池セルの製造方法を提供することにある。

【０００５】

【課題を解決するための手段】前述の課題を解決するために、この発明は、固体高分子電解質膜を挟んで両主面に触媒層を有してなる触媒層・電解質接合体と、この接合体の両側に配設した多孔質の拡散層と、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有してなるセパレータと、他方の拡散層に酸化剤

ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータとを備えた固体高分子型燃料電池セルを製造する方法において、前記触媒層・電解質接合体と拡散層と前記両セパレータとを熱圧着または接着剤等により接合して、燃料電池セル全体を一体化することとする（請求項１）。

【０００６】上記によれば、多数のセルをスタックとして組み立て一体化する作業が容易となり、また各部品の密着一体化により電気接触抵抗の軽減が図れる。

【０００７】また、上記請求項１のように燃料電池セル全体を一体化せず、請求項２の発明のように、触媒層・電解質接合体と拡散層とを部分的に一体化しても、相応の効果が得られる。即ち、固体高分子電解質膜を挟んで両主面に触媒層を有してなる触媒層・電解質接合体と、この接合体の両側に配設した多孔質の拡散層と、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有してなるセパレータと、他方の拡散層に酸化剤ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータとを備えた固体高分子型燃料電池セルを製造する方法において、前記拡散層に固体高分子電解質の溶液を塗布し、前記触媒層・電解質接合体と拡散層とを熱圧着して一体化することとする。

【０００８】前記請求項１または２の実施態様として、下記の方法が好適である。即ち、請求項２記載の製造方法において、前記電解質の溶液塗布は、スプレー法，スクリーン印刷法，ロール印刷法のいずれかの方法により行う（請求項３）。また、請求項２記載の製造方法において、前記熱圧着は、ホットプレス法またはホットロール法により行う（請求項４）。さらに、請求項１記載の製造方法において、前記触媒層・電解質接合体と拡散層とを一体化した後、前記両セパレータを額縁状のセル枠を介して接着し、燃料電池セル全体を一体化する（請求項５）また、前記請求項５の実施態様として、下記が好適である。即ち、請求項５記載の製造方法において、前記接着のために額縁状のセル枠のセパレータおよび電解質膜との接着面にあらかじめ接着層を形成し、熱圧着により一体化する（請求項６）。さらに、前記請求項６記載の製造方法において、前記接着層は、スクリーン印刷またはシート状接着剤により形成する（請求項７）。また、請求項５記載の製造方法において、前記熱圧着は、ホットプレス法またはホットロール法により行う（請求項８）。

【０００９】さらに、請求項９の発明のように、請求項１ないし８のいずれかに記載の製造方法において、前記触媒層・電解質接合体は、ペースト化した触媒層を直接固体高分子電解質膜の両面に塗布し、塗布時のペースト溶液で電解質膜が膨潤による変形をおこす前に加熱圧縮することによって形成することとすることにより、燃料電池セルの全部品が密着一体化され、流れ生産工程に基づく量産性の向上と接触電気抵抗の軽減が図れる。

【００１０】

【発明の実施の形態】図面に基づき、この発明の実施の形態について以下にのべる。

【００１１】図１は、請求項９の発明の実施例に関わり、触媒層・電解質接合体の製作から単セル化までの製作を連続的に行う工程を説明する図である。各工程の詳細は後述するが、図１により全工程の概要を以下に説明する。

【００１２】まず、電解質膜上への触媒層の塗布工程２５において触媒層を形成し、例えばホットロールを用いて触媒層・電解質接合体を一体化した。次に、拡散層一体化工程２６において、電解質溶液を拡散層に塗布し、乾燥後の拡散層を触媒層・電解質接合体の両面に配置し、例えばホットロールにより、温度８０～１５０℃，変形率３０～８０％の加熱変形を施すことで拡散層を接合した。

【００１３】次に、セパレータへのガス流路溝の形成工程２７において溝パターンを塗布されたセパレータを、焼成工程２８で焼成し、セル枠とセパレータとの接合工程２９で、周囲部に接着層を付けたセル枠とセパレータとをホットロールにより、温度８０～１５０℃，変形率３０～８０％で接合した。

【００１４】最後に、単セル一体化工程３０において、セパレータにセル枠を接合したものを、触媒層・電解質接合体と拡散層とを一体化したものの両面に載置し、ホットロールにて温度８０～１５０℃，変形率３０～８０％で一体化することにより、単セルを連続的に得た。

【００１５】上記によれば、燃料電池セルの全部品が流れ生産工程によって密着一体化されるので、量産性の向上と接触電気抵抗の軽減が実現できる。

【００１６】次に、前記の各工程に関して以下に詳述する。図２は、触媒層を電解質膜上に直接塗布する工程２５を説明する断面図である。触媒と電解質溶液を混合したインク１は、湿潤状態の触媒に電解質溶液を１０～５０ｗｔ％の割合で添加し製作した。溝加工ロール３と塗布ロール４の間に触媒層インク１を投入し、溝加工ロール３の溝部分に溜まったインクを塗布ロールに付着させ、電解質膜２の裏表同時に塗布した後、１００～１７０℃，変形率３０～８０％でホットロール５により熱圧着する。

【００１７】図３は、拡散層と触媒層・電解質接合体とを一体化する工程２６を説明する図であり、図３（ａ）は電解質溶液の塗布工程を、（ｂ）は電解質溶液の乾燥工程を、（ｃ）は触媒層・電解質接合体と拡散層との熱圧着工程を示す。拡散層６表面にアルコールで希釈した電解質溶液８をスプレーノズル７により噴霧し、ヒータ１０により８０～１２０℃の温度で乾燥する。続いて、電解質溶液を塗布した拡散層９と触媒層・電解質接合体１１とを、電解質溶液の接着効果により、１００～１７０℃，変形率３０～８０％でホットロールを施し一体化

する。

【００１８】図４は、図１における工程２７～２９を説明する図であり、図４（ａ）はセパレータにおけるガス流路の溝部の塗布工程を、（ｂ）は同溝部の焼成工程を、（ｃ）はセル枠への接着層の塗布工程を、（ｄ）はセル枠とセパレータとの接合工程を示す。

【００１９】セパレータ溝形成用のインク１２は、ジエチレングリコール・エチレエーテルに結合材エチルセルローズを４．２％混合した溶液にカーボン粉末とテフロン粉末を添加したもので、これをスリーンメッシュ１３上に投入して、スキージ１４を用いてセパレート板１５の表面に溝パターンを印刷し、ヒータ１０により１５０～３００℃の温度で焼成する。セルの外形部分となるセル枠１６の表面にスリーンメッシュ１３に投入した接着剤ペースト１７をスキージ１４により塗布し、接着層１８を形成する。溝を形成したセパレータ１９に接着層をつけたセル枠２０を組み合わせて、ホットプレス２１を用いて、温度８０～２００℃,圧力９．８×10^5～10^6Ｐａ（約１０～１００kg/cm^2）で接合する。

【００２０】次に、図５は、図１における工程３０を説明する図であり、図５（ａ）は図１には図示しない図であって、セル枠セパレーター一体化品への接着層の塗布工程を示し、（ｂ）は単セルの一体化工程を示す。

【００２１】セル枠とセパレータを一体化した２２の表面にスリーンメッシュ１３に投入した接着剤ペースト１７をスキージ１４により塗布し、接着層１８を形成し、触媒層・電解質接合体と拡散層とを一体化したもの２４を、セル枠とセパレータとを一体化して表面に接着層をつけたもの２３（２枚）で挟み込み、ホットプレス２１により、温度８０～２００℃,圧力９．８×10^5～10^6Ｐａ（約１０～１００kg/cm^2）で接合して単セル化する。

【００２２】

【発明の効果】上記のとおり、この発明によれば、固体高分子電解質膜を挟んで両主面に触媒層を有してなる触媒層・電解質接合体と、この接合体の両側に配設した多孔質の拡散層と、一方の拡散層に水素を含む燃料ガスを供給・排出するための燃料ガス流路を有してなるセパレータと、他方の拡散層に酸化剤ガスを供給・排出するための酸化剤ガス流路を有してなるセパレータとを備えた固体高分子型燃料電池セルを製造する方法において、前記触媒層・電解質接合体と拡散層と前記両セパレータとを熱圧着または接着剤等により接合して、燃料電池セル全体を一体化することとしたので、組み立て性の改善と電気接触抵抗の軽減を図った固体高分子型燃料電池セルの製造方法を提供することができる。

【図面の簡単な説明】

【図１】この発明の実施例に関わる燃料電池セルの全製造工程の概要を説明する図

【図２】図１における触媒層の塗布工程に関わる図

【図３】図１における触媒層・電解質接合体と拡散層との一体化工程に関わる図

【図４】図１におけるセパレータの製造およびセル枠との接合までの工程に関わる図

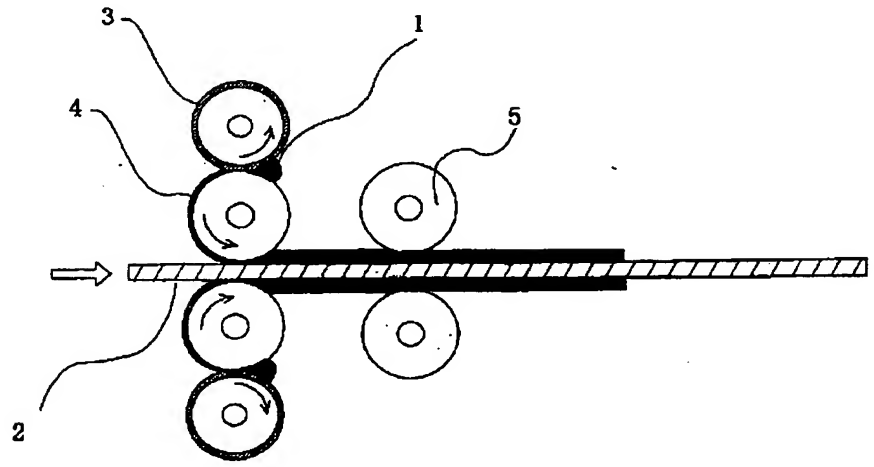
【図５】図１における単セル一体化工程に関わる図

【図６】燃料電池セルの構成の斜視図

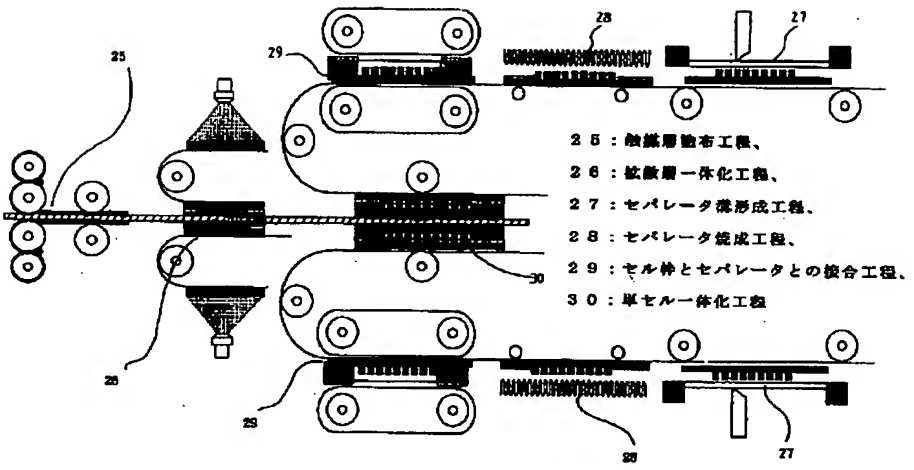
【符号の説明】

１，１２：インク、２：電解質膜、３：溝加工ロール、４：塗布ロール、５：ホットロール、６：拡散層、８：電解質溶液、１０：ヒータ、１１：触媒層・電解質接合体、１６：セル枠、１８：接着層、１９：セパレータ、２１：ホットプレス、２５：触媒層塗布工程、２６：拡散層一体化工程、２７：セパレータ溝形成工程、２８：セパレータ焼成工程、２９：セル枠とセパレータとの接合工程、３０：単セル一体化工程。

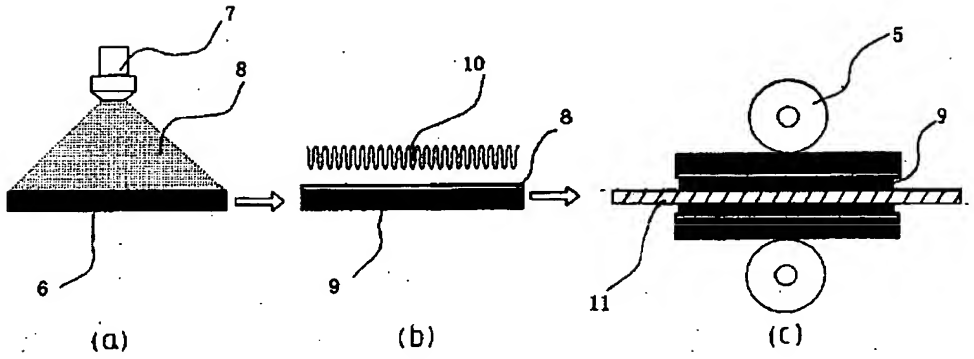
【図２】



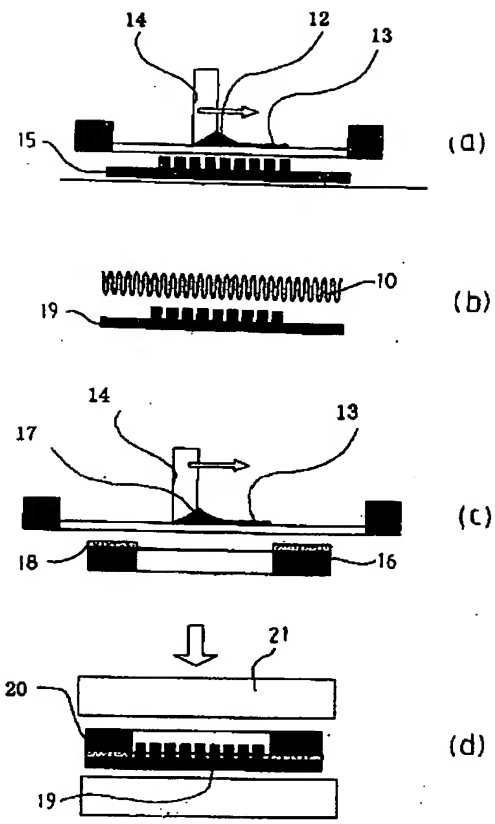
【図１】



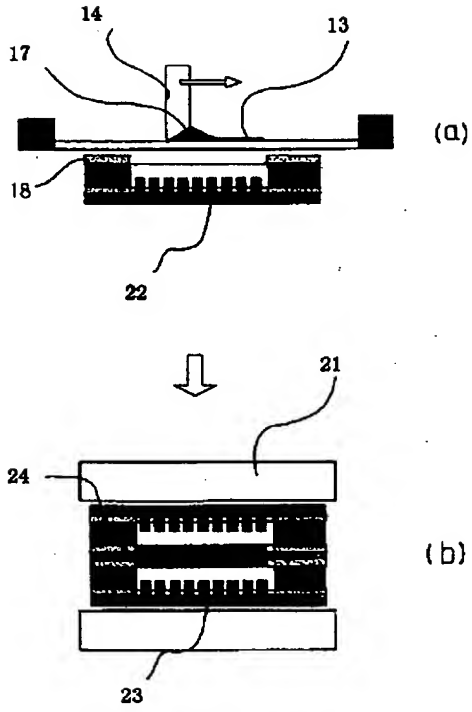
【図３】



【図４】



【図５】



【図６】